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GIFFORD PINCHOT, Forester.

SILVICAL LEAFLET 13.

WESTERN WHITE PINE.

Pinus monticola Dougl.

Western white pine does not form pure stands, nor does it reach such large size as many other western conifers. It is, nevertheless, an important tree not only because it produces wood of excellent quality, little inferior to that of eastern white pine, but also because it invariably grows with other important timber trees in dense forests of high economic value.

RANGE AND OCCURRENCE.

Western white pine is distributed through the forests of the north-western mountains from the west slopes of the Continental Divide, in southern British Columbia and northern Montana, to Vancouver Island and through the mountain ranges of Washington, Oregon, and California as far south as the San Jacinto Mountains. It is most abundant and attains its best development in northern Idaho.

Its altitudinal distribution varies with the climate. Along the coast of southern British Columbia and northern Washington, where there is abundant rainfall, it reaches sea level. Farther inland and toward the southern part of its range, where rainfall is less abundant at low altitudes, it grows at higher elevations with cool temperatures and heavy snowfall. In Idaho and Montana it grows at elevations of from 2,000 to 6,000 feet; in Oregon, from 1,500 to 7,400 feet; in California, from 6,000 feet in the northern part of the State to 11,000 feet in the southern. In California it is often present at timber line. It is usually found at somewhat higher elevations on slopes that are exposed to drying winds than on moister and more protected aspects.

Western white pine prefers cool, moist slopes and river valleys. In northern Idaho it grows best in moist stream bottoms and on gentle north slopes. In Oregon it grows in the Cascade Mountains at higher elevations on the east than on the west slopes. In California it is found on northerly slopes, and on southerly or westerly exposures where protected in coves, broad valleys, or mountain benches. In southern California it is fairly abundant at high elevations on the western slope of the Sierra Nevada.

CLIMATE.

Its wide range subjects western white pine to very diverse climatic conditions. It endures the extremes of -30° and 100° F., and receives an annual precipitation varying from 60 inches near Puget Sound to a minimum of 15 inches in parts of Montana and Idaho. In the northern Rockies and in the mountains of California the snowfall is heavy and remains on the ground well into the summer. In the southern part of its range it is subject to prolonged periods of summer drought.

HABIT.

In the region of its best development and under the most favorable conditions western white pine averages from 135 to 160 feet in height and from 20 to 30 inches in diameter, and occasionally reaches a height of 200 feet and a diameter of 7 feet. In California it rarely exceeds 135 feet in height and 3 feet in diameter. In a dense stand it has a long cylindrical bole, clear of branches for half its length and has but little taper. The crown is conical, with short, widely spaced branches. In poorer and more open situations the tree is shorter and more spreading, with more rapid taper and less clear length. The leaves fall partly during their third and partly during their fourth season.

The root-system is spreading and fairly deep. Windfall is not uncommon, however, especially among very old individuals and in places where trees which have grown in dense stands are suddenly exposed. The bark is thin during youth, and young trees are easily killed by fire. Even the moderately thick bark of old trees is damaged by fire and prepared to encourage the entrance of fungi. The tree is particularly susceptible to a ground rot (*Polyporus schweinitzii* Fr.), which is the primary cause of most of the damage from windfall. A large proportion of the mature stand is usually attacked by butt-rot.

Western white pine varies greatly in rate of growth with locality. It is, in general, a tree of slow growth during youth, of rapid increase in height from the tenth to the fortieth and, in diameter, to the

ninetieth year, and thereafter of slower and more persistent development until decadence sets in, somewhere between the ages of 200 and 300 years. In northern Idaho it attains a diameter of 12 inches at the age of 100 years, and becomes merchantable at from 60 to 80 years, with a breasthigh diameter of 9 inches.

ASSOCIATED SPECIES.

It never forms pure stands, but commonly occurs through the forest, as single individuals or in small, scattered groups. In northern Idaho it frequently forms one-half the stand within its altitudinal range, with western larch and giant arborvitæ as chief, and western hemlock, Engelmann spruce, Douglas, lowland, and alpine firs, cottonwood, and white birch as secondary associates. The forest is dense, the trees are clear and well formed, and a heavy layer of humus is maintained. In Washington and Oregon its chief associates are western hemlock and amabilis, Douglas, and white firs. In the Cascade Mountains of Oregon it is very scattering on the east slope, where it associates with Douglas and white firs, Engelmann spruce, and yellow pine. On the west slope it is more abundant. Here it is sparsely scattered at its lower limits in an almost pure Douglas fir forest, which changes in composition with increasing altitude by the addition of western hemlock, giant arborvitæ, and amabilis fir, and is most abundant at an elevation of 3,500 to 4,500 feet in mixture with western hemlock, western larch, and white fir. In the Sierra Nevada of California it is rarely absent from the dense forest of California red fir, and is also associated with Douglas fir, lodgepole pine, and black hemlock. In the San Bernardino National Forest it occurs at an altitude of 10,000 feet, together with lodgepole and white-bark pines.

SOIL AND MOISTURE.

Western white pine is adapted to a variety of soils. Its chief requirement is a sufficient supply of soil moisture. Its best growth is made in deep, moist, but well-drained, porous soils, but it also grows abundantly on poor, sandy situations, frequently shallow and rocky.

TOLERANCE.

Western white pine is intolerant of heavy shade throughout its life. It is more tolerant than western larch, Douglas fir, and lodgepole and sugar pines, and less so than western hemlock, giant arborvitæ, and Engelmann spruce. It is more tolerant during its earlier stages than in later life. Under heavy shading from above, saplings are crooked and branchy, scant-foliaged, and of slow growth. Power

of recovery from suppression is lost relatively early in life. The tree responds fairly well to side shading and in dense stands produces long, clear stems.

REPRODUCTION.

Seed production does not usually begin at an early age; such occasional small trees as bear fruit are old and have had a slow growth. Western white pine is not a very prolific seed bearer. Some seed is produced every year, but years of especially abundant production occur at intervals of from four to six years. The seeds are of fair size, but well winged, and are scattered by the wind. The most favorable seed bed is a fresh mineral soil. The seedlings require a broken shade during the first year, but in the north are unable, under heavy shade, to compete with young growth of more shade-enduring species, such as western hemlock and giant arborvitæ.

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